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(19)(CA) **APPLICATION FOR CANADIAN PATENT** (12)

(54) Portable Security Device

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PORTABLE SECURITY DEVICE

Abstract

Personal security devices and methods are characterized in that a portable security unit includes a wireless telephone system interface connected to a global positioning system (GPS) receiver having a geographic position output. The interface is also connected to an activation device for activating the interface, as in an emergency situation. Upon activation, the interface automatically establishes a connection with a wireless telephone system, dials a predetermined telephone number corresponding to a called telephone device and, upon connection to the called telephone device, delivers a message including the geographic position output to the called telephone device.

PORTABLE SECURITY DEVICE

Technical Field of the Invention

The present invention relates generally to portable security devices, and more particularly to a new and useful personal security device which employs a wireless telephone system interface for use with a global positioning system.

Background of the Invention

Significant numbers of individuals are acquiring wireless telephones for personal security and for use in emergency situations. However, as a personal security device, the wireless telephone has certain limitations. For example, state-of-the-art portable cellular telephones are somewhat heavy and bulky for unobtrusive, concealed transport in one's shirt pocket. More importantly, the many small buttons and controls on these cellular telephones are often difficult to manipulate during crisis situations where the user is nervous and/or excited. In an emergency, precious time could be wasted while the user repeatedly fumbles around trying to push the right buttons in the right sequence to complete a call to the proper authorities. This difficulty is further exacerbated in weak-signal or multipath-ridden areas, where the user may be required to hold the cellular telephone in an awkward position to achieve an adequate RF communications link. Moreover, the electrical current consumption of these portable cellular telephones is not insignificant, with the result that the battery pack may be exhausted when an emergency situation arises.

Wireless telephones other than cellular could be employed as personal security devices. However, many of these systems are limited in geographical coverage to the premises of a home or business, and would be of limited utility in providing personal security to an individual going about his or her daily routine. Routine activities, such as shopping, banking, recreation, and attending religious services, often involve travel throughout significant portions of a metropolitan area. To be effective in providing security, a wireless telephone system should cover as wide an area as possible, such as an entire metropolitan region and the surrounding rural and suburban areas.

Regardless of which type of wireless telephone is used as a personal security device, existing telephones present a significant shortcoming when used to summon aid in an emergency. The caller must provide his or her location to the authorities. If this information is not provided, the authorities may not be able to determine the site of the emergency, even if the caller is in an area offering 911 service. Although the location of the caller is automatically displayed for the 911 operator to see, existing 911 systems cannot display useful location information for cellular callers. At best, the cell site of the

emergency is ascertainable, but the site of the emergency within the cell cannot be determined.

In the prior art, global positioning system (GPS) receivers have been used in conjunction with cellular telephone systems for the purpose of optimizing cell site selection and cell hand-offs during a cellular telephone call. In response to positioning signals transmitted by one or more satellites engaged in geo-synchronous orbit about the earth, GPS receivers determine the coordinates (latitude and longitude) of the receiver's present geographic location. For example, U.S. Patent 5,235,633 discloses a cell selection technique which directs cellular telephone calls to a cell site appropriate for handling the call, based upon a lookup table which associates a geographic location as determined by GPS with a corresponding cell site. The lookup table is based upon minimizing the distance between the cellular caller and the cell site used to handle the call.

Existing wireless telephones, such as cellular mobile telephones, were designed for the purpose of interpersonal communications, and are not especially well-suited for use as security devices. In an emergency situation, time is of the essence. A security device should be relatively compact and easy to use, requiring the activation of as few buttons and switches as possible. The actions of powering up a conventional cellular telephone, waiting for communications to be established with a cell site, and dialing in a conventional telephone number, require too much user intervention in the way of button-pushing to render the cellular telephone a truly effective tool for use in emergency situations. Furthermore, in an emergency, it is neither necessary nor desirable for the cellular telephone to consume valuable time establishing and optimizing a communications link.

What is needed is a portable security unit which is small enough to conveniently carry around in one's pocket or purse. The device should automatically identify the location of the emergency to the authorities. Since the device will be used in emergency situations, it should be easily activated with a minimum amount of intervention and/or fumbling on the part of the user.

Summary of the Invention

Personal security devices and methods are characterized in that a portable security unit includes a wireless telephone system interface connected to a global positioning system (GPS) receiver having a geographic position output. The interface is also connected to an activation device for activating the interface, as in an emergency situation. Upon activation, the interface automatically establishes a connection with a wireless telephone system, dials a predetermined telephone number corresponding to a

called telephone device and, upon connection to the called telephone device, delivers a message including the geographic position output to the called telephone device.

Brief Description of the Drawings

FIG. 1 is a hardware block diagram showing a personal security device constructed in accordance with an embodiment disclosed herein.

Detailed Description of the Preferred Embodiments

FIG. 1 is a hardware block diagram showing a personal security device 200 constructed in accordance with an embodiment of the invention disclosed herein. Personal security device 200 includes a wireless telephone system interface 202 connected to a processor 204. Wireless telephone system interface 202 is adapted to implement an RF communications link with a wireless telephone system. For example, if the wireless telephone system is a cellular system 206, wireless telephone system interface 202 includes a transceiver operating in the frequency range of 800 mHz to 1000 mHz. These transceivers are known to those skilled in the art, and are incorporated, for example, into all existing cellular mobile telephone designs. Note that wireless telephone system interface 202 implements the functions necessary to provide a communications link with an existing wireless telephone system. Therefore, this interface 202 may or may not include an entire wireless telephone device.

The processor 204 controls the operation of the wireless telephone system interface 202. Suitable processors for use in personal security device 200 include, for example, commonly-available microprocessors well-known to those skilled in the art. A working memory area 211 within processor 204 or, alternatively, coupled to processor 204, provides one or more registers for temporarily storing one or more numerical values, and/or for performing mathematical operations on these values. These numerical values may represent, for example, telephone numbers of emergency service providers.

Processor 204 is equipped to provide system interface 202 with wireless telephone system access command signals when activation switch mechanism 205 is activated. These command signals instruct a signal generator 203 within system interface 202 to produce the necessary timing, control, network access, and/or handshaking signals required to establish a communications link with a wireless telephone system such as cellular system 206. In the case of existing wireless systems, these signals have been defined at length in the prior art and are well-known to those skilled in the art.

The processor 204 is connected to memory 208. In addition to electronically storing the required timing, control, network access, and/or handshaking signals, memory 208 is especially adapted for the storage of an electronic representation of a

voice message. Memory 208 may consist, for example, of random-access memory (RAM) and/or read-only memory, which is optionally combined with a conventional magnetic tape storage device. In this manner, the voice messages could be stored in RAM and/or on a magnetic tape such as the mini-cassette tape commonly employed in many present-day telephone answering machines. Processor 204 and/or memory 208 also contains a geographic location register 213 which may be used for the temporary storage of numerical values specifying a geographic location in latitude and longitude.

Voice messages stored in memory 208 consists of one or more user-selectable "help" messages which indicate that an individual is in an emergency situation and requires immediate help. These messages could be drafted to suit specific categories of emergency situations, such as personal attacks, fires, medical emergencies, and automobile breakdowns. For example, a first message could specify "Please summon the police; I have been attacked", a second message could indicate "Please send the fire department to put out a fire", a third message would be tailored to medical emergencies ("please send an ambulance"), and a fourth message would be geared to automobile emergencies ("please send a tow truck").

It is to be understood that a greater or lesser number of emergency messages could be employed to meet the requirements of specific system applications. For example, a simple system need only carry one generic "HELP" message which covers virtually all conceivable types of emergencies. A personal security system 200 used in the environment of a retirement community may be programmed only to carry medical emergency help messages. Factories may be equipped with systems providing both "fire" and "medical emergency" messages. Systems used by motorists could include a message for summoning a tow truck, and another message for summoning the police to the scene of a personal attack.

Although the embodiment disclosed in FIG. 1 sets forth a personal security device which contains one or more prerecorded or stored "help" messages, an alternate embodiment provides for the real-time delivery of actual voice messages spoken by the party requiring aid. This alternate embodiment would still require the use of memory 208 for the purpose of storing the aforementioned signaling information, but prerecorded voice messages need not be stored in memory 208. Rather, the personal security device 200 is equipped with an optional microphone connected to the wireless telephone system interface 202. In the environment of cellular telephony, the microphone is used to modulate a transceiver operating in the frequency range of 800 mHz - 1000 mHz which transmits spoken voice messages to the cellular system 206.

The processor 204 is used to selectively activate a global positioning system (GPS) receiver 210. Upon activation, the GPS receiver 210 responds to a location signal transmitted by a GPS satellite 201 to produce a geographic position output specifying the current location of the GPS receiver in latitude and longitude. The GPS satellite 201 is engaged in geo-synchronous orbit about the Earth. Suitable GPS receivers are available from various vendors including the Sony Corporation, and are well-known to those skilled in the art. The presently-existing civilian GPS system can fix the position of an individual to within 76 meters, whereas the current military GPS system is accurate to within 16 meters.

The processor 204 is connected to an activation switch mechanism 205 for activating the GPS receiver 210 and the wireless telephone system interface 202, as in an emergency situation. Activation switch mechanism 205 includes one or more push buttons, such as FIRE 230, POLICE 232, and AUTO CLUB 234, which are activated by the security device 200 user in an emergency. Particular push buttons correspond to specific categories of emergencies. For example, FIRE 230 push button is depressed in the event of a fire, and POLICE 232 push button is depressed in the event of a physical attack or mugging.

The categories of emergencies set forth in the above paragraph are illustrative, and it is to be understood that the personal security device 200 may be used to summon aid in other types of emergencies. Similarly, emergencies may be categorized differently from that described above to meet the requirements of specific system applications. For example, in the context of a highway motorist, push buttons for various types of automobile emergency situations may be provided, such as "send tow truck", "out of gas", "accident with injuries", etc.

Once the activation switch mechanism 205 is activated by the pressing of a push button switch such as, for example, FIRE 230 or POLICE 232, a processor 204 interrupt corresponding to a specific push button switch is triggered, and the process 204 stores a numerical value in the processor's working memory area uniquely specifying the push button which was pressed. This numerical value is conceptualized as an emergency category specifier. Next, the processor 204 activates the GPS receiver 210. The GPS receiver 210 receives position signals transmitted by GPS satellite 201, and thus determines the geographic location at which the receiver was activated. This geographic location is specified in the form of a first numerical value representing latitude and a second numerical value representing longitude. These numerical values are in digital form, and are forwarded to the geographic location register 213 in processor 204 or memory 208.

After the geographic location of the security device 200 has been determined, the processor 204 establishes a connection with a wireless telephone system such as cellular system 206 through wireless telephone system interface 202. From memory 208, the processor 204 retrieves the signals necessary to establish and maintain a communications link with cellular system 206. These signals are forwarded to wireless telephone system interface 202 where the signals are modulated onto an RF carrier, transmitted over antenna 215, and received by a cell site antenna 220 coupled to a cell site transceiver 222 and cell site control circuitry 224.

Upon the establishment of a communications link between the security device 200 and cell site control circuitry 224, processor 204 retrieves the emergency category specifier from the processor working memory area. The processor 204 then consults an emergency telephone number lookup table stored in memory 208 which associates each emergency category specifier with a telephone number of an emergency service provider and a digitized representation of a voice emergency message. The processor 204 retrieves the telephone number of the emergency service provider corresponding to the emergency category specifier from the telephone number lookup table and places this number into the processor working memory area.

An alternate embodiment uses an activation switch mechanism 205 which includes one push button. This push button may simply be labeled "HELP". In this manner, no emergency category specifiers are required, and no telephone number lookup table is needed. Upon activation of the switch mechanism, the processor 204 merely retrieves the telephone number of one emergency service provider, such as the 911 emergency number used in various countries throughout the world, including the United States.

The processor 204 uses the telephone number stored in the working memory area to activate a DTMF tone generator 217 equipped to dial one or more telephone numbers in response to processor 204 commands. These numbers include, for example, 911, the police department, the fire department, paramedics, motor club road service, or the like. The telephone number generated by DTMF tone generator 217 is modulated onto an RF signal and transmitted by wireless telephone system interface 202, radiated by antenna 215, and reaches cell site antenna 220.

Upon receipt of the RF signal at cell site antenna 220 , the signal is received and demodulated at cell site transceiver 222. The demodulated information, including the telephone number dialed by DTMF tone generator 217, is presented to cell site control circuitry. Cell site control circuitry 224 activates a switching network 226 to signal an emergency service provider 228 as to the existence of an incoming call. Emergency

service provider 228 may be a rescue 911 service, the police, the fire department, motor club, or the like. The incoming call signal is provided to the emergency service provider in the form of a conventional ringing signal. Concurrently with the sending of the ringing signal to the service provider 228, a ringback signal is modulated onto an RF signal transmitted by the cell site transceiver 222 and radiated by antenna 220. The ringback signal signifies that the incoming line of the called party (i.e., the service provider 228) is ringing.

Once the service provider 228 answers the incoming call, the cell site control circuitry 224 terminates the ringback signal. The wireless telephone system interface 202 conveys the absence of the ringback signal to the processor 204. In turn, the processor 204 consults the telephone number lookup table to retrieve a digitized representation of a voice emergency message which corresponds to the telephone number that was dialed. This digitized representation is fed to a speech synthesizer 219 which converts the message into an analog form representing speech and delivers the analog message to wireless telephone system interface 202, which modulates the message onto an RF carrier for transmission to cellular system 206. Typical voice emergency messages are "A tow truck is needed at", "A serious accident has occurred at", "Send the police to", "Send a fire truck to", etc.

Immediately after delivery of an aforementioned voice emergency message, the geographic location at which the GPS receiver was activated is retrieved from the geographic location register 213. This geographic location is specified in the form of a first numerical value representing latitude and a second numerical value representing longitude. These numerical values are in digital form, and are forwarded to the speech synthesizer 219 which is programmed to convert the numerical values into an analog form representing speech. If the first numerical value is positive, North latitudes are denoted, whereas if this value is negative, South latitudes are specified. Similarly, if the second numerical value is positive, West longitudes are specified, whereas negative values denote East longitudes.

The speech synthesizer 219 distinguishes positive geographic location values from negative values, and, therefore, is equipped to distinguish North latitudes from South latitudes, and to distinguish East longitudes from West longitudes. In this manner, speech synthesizer 219 inserts the phrase "degrees latitude North" or "degrees latitude South" after the first numerical value, and inserts the phrase "degrees longitude West" or "degrees longitude East" after the second numerical value. Latitude and longitude may be stored and converted to speech in degree-decimal format, such as +39.909167 degrees, +75.100000 degrees. Alternatively, latitude and longitude can be stored in degree-

decimal format, and converted into degrees-minutes-second format (39 degrees, 54 minutes, 33 seconds North latitude, 75 degrees, 6 minutes, 0 seconds West longitude) by processor 204, prior to being converted into speech by speech synthesizer 219. In this alternate embodiment, the speech synthesizer may be programmed to deliver the terms "degrees", "minutes", and "seconds" at the appropriate times.

Although the embodiment described above results in the delivery of an emergency message in voice form to an emergency service provider 228, it is possible to provide a non-voice message to the emergency service provider 228, or a hybrid message containing both voice and non-voice portions. For example, a voice emergency message could be sent which indicates the nature of the emergency (i.e., my house is on fire), followed by geographic location values sent in binary or digital form. Alternatively, both the geographic location values and the nature of the emergency may be sent in binary or digital form. Whether some, all, or none of the message is in voice form is dependent upon the facilities available to emergency service provider 228.

What is claimed:

1. A portable security unit characterized by:

interface means for establishing a communications link with a wireless telephone system;

location determination means including a global positioning system (GPS) receiver coupled to the interface means and having a geographic position output specifying the current location of the portable security unit; and

activation switch means coupled to the interface means for activating the interface means such that, upon activation, the interface means establishes a communications link with a wireless telephone system, dials a predetermined telephone number corresponding to a called telephone device and, upon connection to the called telephone device, delivers a message including the geographic position output to the called telephone device.

2. A portable security unit as set forth in Claim **1** further characterized in that the activation switch means is activated using any of a plurality of emergency switches, each emergency switch corresponding to a specific predetermined telephone number.

3. A portable security unit as set forth in Claim **2** further characterized in that at least one of the plurality of emergency switches correspond to specific emergency categories selected from the group of fire emergencies, police emergencies, automobile emergencies, and medical emergencies.

4. A portable security unit as set forth in Claim **1** further characterized in that the message further comprises a voice emergency message intended to elicit help or assistance.

5. A portable security unit as set forth in Claim **3** further characterized by a first emergency switch and a second emergency switch such that, upon activation of the first emergency switch, the interface means establishes a communications link with the wireless telephone system, dials a first predetermined telephone number corresponding to a first called telephone device and, upon connection to the first called telephone device, delivers a first voice message including the geographic position output to the first called telephone device;

and, upon activation of the second emergency switch, the interface means establishes a communications link with the wireless telephone system, dials a second predetermined telephone number corresponding to a second called telephone device and,

upon connection to the second called telephone device, delivers a second voice message including the geographic position output to the second called telephone device.

6. A portable security unit characterized by:

interface means for establishing a communications link with a wireless telephone system; and

activation switch means coupled to the interface means for activating the interface means such that, upon activation, the interface means establishes a communications link with a wireless telephone system, dials a predetermined telephone number corresponding to a called telephone device and, upon connection to the called telephone device, delivers a message to the called telephone device.

7. A portable security unit as set forth in Claim **6** further characterized in that the message includes a geographic position.

8. A security system characterized by:

(a) a global positioning satellite network including one or more global positioning satellites for transmitting geographic location information specifying a geographic position; and

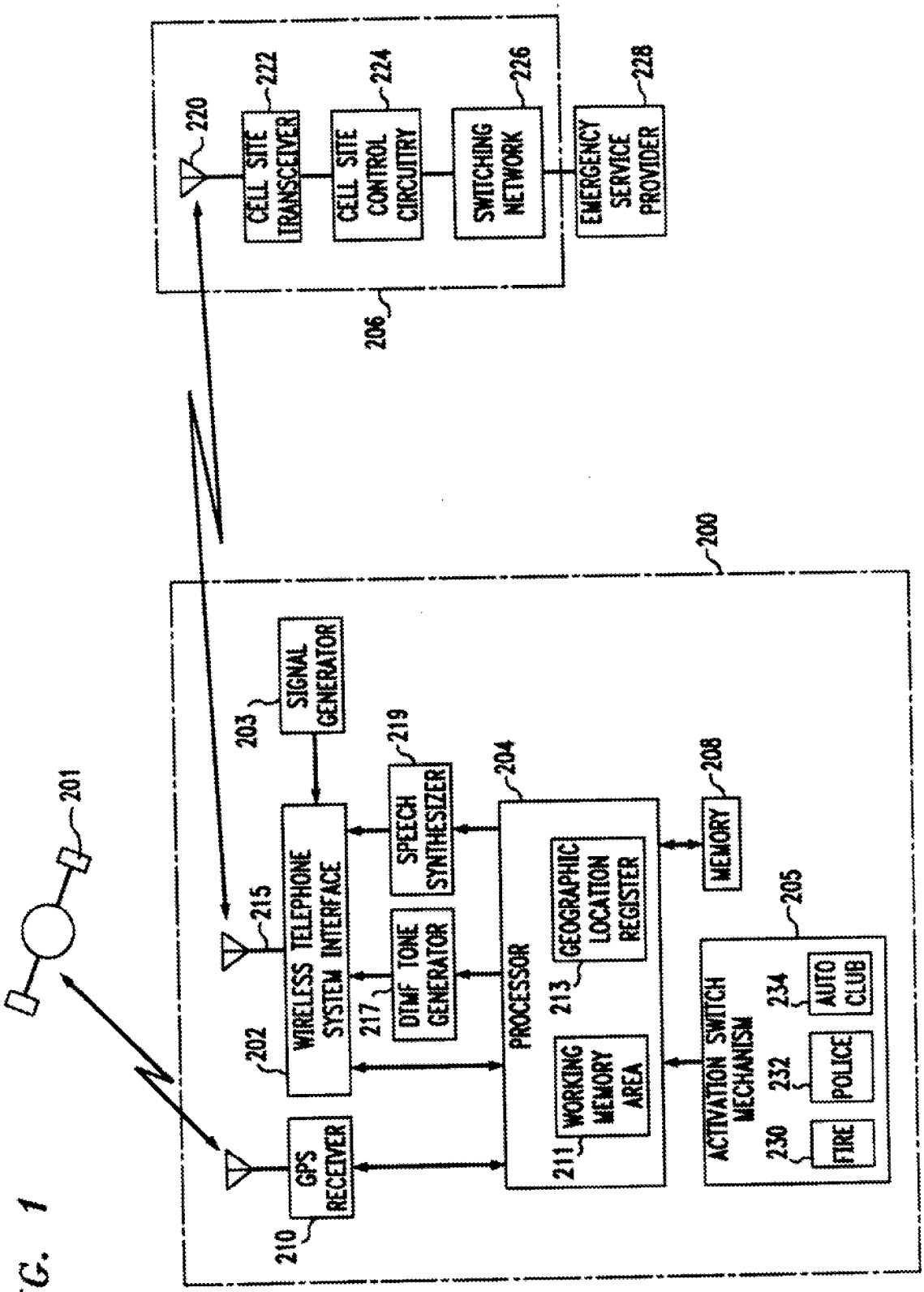
(b) a portable security unit characterized by:

interface means for establishing a communications link with a wireless telephone system;

location determination means including a global positioning system (GPS) receiver coupled to the interface means and responsive to the global positioning satellite network for producing a geographic position output specifying the current location of the portable security unit; and

activation switch means coupled to the interface means for activating the interface means such that, upon activation, the interface means establishes a communications link with a wireless telephone system, dials a predetermined telephone number corresponding to a called telephone device and, upon connection to the called telephone device, delivers a message including the geographic position output to the called telephone device.

FIG. 1


201
200
206
220
222
CELL SITE TRANSCEIVER
224
CELL SITE CONTROL CIRCUITRY
226
SWITCHING NETWORK
228
EMERGENCY SERVICE PROVIDER
203
SIGNAL GENERATOR
219
SPEECH SYNTHESIZER
204
208
MEMORY
215
WIRELESS TELEPHONE SYSTEM INTERFACE
202
217
DTMF TONE GENERATOR
PROCESSOR
213
GEOGRAPHIC LOCATION REGISTER
205
ACTIVATION SWITCH MECHANISM
234
AUTO CLUB
232
POLICE
230
FIRE
211
WORKING MEMORY AREA
210
GPS RECEIVER